ing his models in water and circulating colored kerosene oil through them, the models being built with glass sides to permit observation.

A great many illustrations and drawings of furnaces, with more or less detail, have been printed from time to time. Attention was occasionally called to certain differences, generally to an increase in the size of certain parts above those of some well-known furnace. The reasons for changes not being stated, it was possible to make many inferences.

While the title of this work, "The Flow of Gases in Furnaces/[7] explains its purpose, it is an abbreviation of the title of the French edition, which may be rendered into English as "An Essay upon a Theory concerning Hot Gases in Furnaces based upon the Laws of Hydraulics/[7] The work treats of the development of the flow laws of heated gases and the application of those laws to the rational design of furnaces. Primarily, a furnace, considered as an elementary structure, is merely a hollow structure of refractory material, within which heat may be released. A great many furnaces show that their designers had very elementary ideas concerning the application and utilization of heat. *Damour* has given the following definition of industrial heating, which sums up the question:

" Industrial heating has for its objective *the realization of a temperature more or less high, with economy, within an enclosure of known dimensions, making use of a selected combustible (or form of heat energy), for effecting a certain operation or chemical reaction.*

"High temperature, economy, various combustibles, fixed dimensions of the furnace or its heating chamber, a certain industrial operation—such are the five variables of the problem. Industrial heating operations present an infinite variety of results to be accomplished. The engineer must be able to see all sides of the problem; he must understand the various

furnaces required, their proper operation, the correction of their defects, and above all the rational solution of each particular case. Each phase of the question calls for many different forms of knowledge, with each of which the engineer must be equally familiar; but it is essential that he carefully distinguish between them, lest he become confused or fall into those errors which frequently retard the progress of the science of furnaces."

In a preceding paragraph *Damour* states: "All forms of energy may be converted into heat, either directly by a single apparatus